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ENVIRONMENTALLY SOUND MANAGEMENT OF HAZARDOUS WASTES: BACKGROUND

Report of the Secretary-General of the Conference

INTRODUCTION

1. By its decision 2/14, the Preparatory Committee for the United Nations Conference on Environment and Development requested the Secretary General of the Conference to submit to the Preparatory Committee at its third session a report elaborating further the potential areas for action, as outlined in the Progress Report on "Environmentally Sound Management of Wastes, particularly Hazardous Wastes" presented to the second session of the UNCED Preparatory Committee (document A/CONF 151/PC/34).

2. The present report provides the background and basis for elaborating options for an action programme on environmentally sound management of hazardous wastes. The options for action are presented in a complementary second report (document A/CONF.151/PC/42/Add.9) outlining the objectives, goals and main programme areas and activities envisaged in the field of hazardous wastes for incorporation into Agenda 21.

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3. The report describes the principal issues related to environmentally sound management of hazardous wastes and under each issue identifies some of the main constraints and gaps in knowledge as well as future needs. It also reviews current approaches and activities being undertaken at the international level in hazardous waste management, particularly those relating to transboundary movements of hazardous wastes.

4. In preparing this report, account has been taken of relevant paragraphs of the Bergen Ministerial Declaration on Sustainable Development in the ECE Region, of the Tlatelolco Platform on Environment and Development, adopted by the Ministers and representatives of the Latin American and Caribbean countries members of the ECLAC earlier this year and of the Ministerial Declaration on Environmentally Sound and Sustainable Development in Asia and the Pacific.

5. Very valuable contributions for the preparation of this report were received from several organizations and institutions, including inter alia the United Nations Environment Programme, the Interim Secretariat for the Basel Convention, the World Health Organization, the United Nations Industrial Development Organization, the Organization for Economic Cooperation and Development, the Pacific Basin Consortium for Hazardous Waste Research, the World Bank and the International Chamber of Commerce.

6. Members of the informal Working Party on Hazardous Wastes also provided very useful advice and assistance in the preparation of this report.

I. WASTE PREVENTION AND MINIMIZATION THROUGH THE "CLEANER PRODUCTION" APPROACH AND RECYCLING/CONVERSION OF WASTE

Introduction

7. There is an increase in the amount of residues which are not being reintegrated into the economic system, causing considerable problems for human health and environmental quality. The volume and complexity of waste generation and its composition have also changed substantially over the years. The production of hazardous waste has become a particular focus of concern. OECD European countries generate roughly 24 million tonnes of hazardous waste annually; the cost of properly managing these wastes averaged about $100 per tonne in 1989. Eastern European countries excluding the USSR generated 5 to 6 million tonnes of hazardous waste in 1988. Generation rates for developing countries are not well known. However, on the basis of the list of hazardous wastes adopted by the Basel Convention, a fairly reasonable estimate is that for each one million dollars of annual gross domestic product in developing countries, the quantity of these wastes falls in the range of 2.5 to 4.5 tonnes. Thus, on average, a country having a gross domestic product of $1 billion is likely to have to manage about 35,000 tonnes of hazardous wastes yearly.

8. Waste minimization has emerged as the top priority in the hierarchy of waste management options ranging from reduction at source, through recycling and reuse to treatment and safe disposal. Waste minimization involves the elimination of waste generation through technological and managerial change. It is also part of a broader, preventive approach to environmental management, which includes pollution prevention and clean(er) technology strategies.

Key Factors in waste minimization

9. Industry plays an important role in the waste cycle from the design of products, through their manufacture to influencing their consumption, and ultimate disposal, but is however, subject to a number of constraints differently weighted during the decision-making process. For each waste stream within a company, a wide range of different factors and criteria are involved in the decision on whether or not to adopt waste minimization as part of the overall production strategy.

10. A number of methods can be used to minimize waste as well as other discharges including good housekeeping, organizational changes, materials' substitution, production modification, product reformation, and materials recovery.

11. Internally, since waste minimization is a multi-disciplinary issue, each corporate function plays a key role in the decisions concerning waste minimization, in particular research and development staff, product designers, production managers, marketing executives, environmental specialists and financial controllers. This means that all staff involved in these functions have to integrate the environmental dimension in their activities if waste minimization is to be achieved.

12. Externally, the range of constituencies which influence the decision-making process include:

- Authorities, such as those responsible for industrial development, finance, planning, environment;

- Raw material and equipment suppliers, who can influence the scope for process change and materials substitution in pursuit of waste minimization;

- Consumers, whose perceived needs and expectations can exert a powerful influence on companies to adopt waste minimization practices, particularly if this involves product reformulation or replacement;

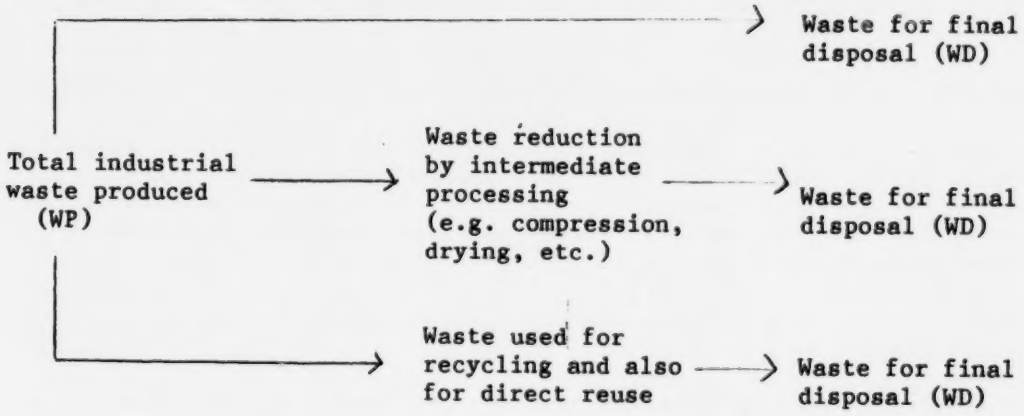
- Financiers, since waste minimization programmes compete for scarce resources and must be shown to be cost-effective in order to receive financial support;

- Intermediaries, including for example, consultants, trade organizations, labour unions, environmental groups and the media, each of whom play an important role in helping companies to be more aware of the needs for waste minimization.

13. Together, these internal and external constituencies influence which production, technology and product will be chosen and the extent to which waste minimization policies will be adopted.

Key factors in waste recycling/conversion of waste

14. Waste recycling and conversion of waste follow waste minimization at the end of unit processes or at the end of the pipeline. Classification of waste needs to begin at source and the aim must be to recycle or reuse waste wherever feasible and keep to a minimum the amount of waste for final disposal as indicated in the following diagram. In addition, good manufacturing practice and promotion of cleaner technology play an important role for waste minimization as indicated in previous sections.


Waste for final disposal (WD)
Total industrial waste produced (WP)
Waste reduction by intermediate processing (e.g. compression, drying, etc.)
Waste for final disposal (WD)
Waste used for recycling and also for direct reuse
Waste for final disposal (WD)

15. It is very important that the ratio of WD/WP is kept to a minimum.

16. Waste minimization performance in an industrial operation could be better assessed and improved by keeping good records of:

- Output of total waste including those defined as hazardous waste;
- Output of pollutants that are especially harmful and which come within the definition of hazardous waste;
- Monitoring waste produced (WP), recycled, treated and sent for final disposal (WD);
- Waste produced per ton of product;
- Energy/water used per unit of production;
- Complaints from public/employees.

Review of the Current Situation

17. There is considerable scope for improvement. Until recently, most effort was given to pollution control, which, while reducing pollution, regarded the generation of waste as peripheral to the production process. Regulatory efforts to manage the problem have focussed on "end of pipe" control strategies, emphasizing for example, scrubbers and filters. Also, regulations have tended to take a medium-specific approach to waste management, often resulting in the transfer of pollutants from one medium to another. Industry generally has taken a reactive approach, rarely moving beyond regulatory compliance.

18. It has become clear now that this reactive approach is inefficient. A growing range of measures are being adopted by governments, industry and international organizations to promote a more cost-effective preventive approach to waste management.

19. At the government level, new legislative aproaches include: waste minimization requirements; toxic release and waste inventory disclosure requirements; integration of economic and environmental policies; and reduction or elimination of the use of certain hazardous substances. Institutional administrative mechanisms are being established to support these legislative requirements.

20. Incentive schemes such as concessional loans and tax incentives to encourage investment as well as financial support for research and development and for pilot and demonstration projects are being used to facilitate and encourage greater application of waste minimization.

21. At the industry level, companies have launched waste reduction programmes with both quantitative and qualitative targets and goals. Industry associations are starting to collect and disseminate information reviewing the environmental performance of their members. Industrial sectors have signed voluntary agreements with governments to reduce waste and other forms of pollution. Collaborative ventures have been introduced for emissions reduction.

22. Non-governmental organizations, such as the Environmental Liaison Centre International (ECLI) and Greenpeace have been very active in raising public and consumer awareness of these issues.

International cooperation

23. The United Nations and other international organizations play a role in stimulating action and diffusing information on best practices in waste minimization.

24. Within the UN system, UNEP/IEO plays a catalytic role through its "cleaner production" programme. The "cleaner production concept" includes a "cradle to grave" approach for minimizing emissions into air, water and soil, as well as for minimizing energy consumption and use of raw materials. This means not only developing new technologies, but also implementing good operating practices. It implies the commitment of all sections of society to change overall consumption and production systems that produce less wastes.

25. The United Nations agencies concerned with industrial development promote the use of cleaner technologies and environmentally sound management practices in their training and technical assistance programmes. Similarly, the development banks are now including environmental criteria in the assessment of industrial projects.

26. The OECD and other international organizations are active in developing a better understanding of the economic and trade implications of promoting cleaner production and consumption patterns. The European Community and others, also support research activities.

27. OECD will also be developing and implementing a programme of activities concerning wastes destined for recovery operations including, inter alia, distinguishing recyclables from waste destined for disposal. This programme will be conducted in cooperation with other international organizations and bodies, in particular the United Nations Environment Programme, the United Nations Economic Commission for Europe and the Commission of the European Communities. It should, inter alia, clarify the definition of wastes, characterize those wastes requiring different levels of control and identify and assess environmentally sound and economically efficient practices for recovery operations. It will develop means to determine quantities of wastes subject to recovery operations as compared to those finally disposed and it will identify uses of wastes in substituting for primary raw materials and in preserving natural resources. Finally, it will delineate what controls would be appropriate for the transfrontier movements of waste materials destined for recovery operations. The results of this work should be helpful in developing multilateral agreement pursuant to Article 11 of the Basel Convention to govern transfrontier movements of wastes destined for recovery operations.

28. International conventions have been adopted, reflecting a global consensus on the need to go from cure to prevention. They include:

- The 1972 London Dumping Convention on the Prevention of Marine Pollution, which stresses the importance of waste avoidance and clean production methods;

- The 1989 Basel Convention on the Control of Transboundary Movement of Hazardous Wastes which emphasizes the need for waste reduction.

29. A number of international labour standards aimed at securing safer and cleaner working environments contribute to waste minimization and cleaner production. The emphasis is on chemicals classification, labelling of hazardous chemicals, chemical data sheets, the responsibilities of suppliers and employers and the rights of workers.

Technologies for recycling and conversion of waste

30. Technologies routinely used for recycling and conversion of waste prior to final disposal depend on the individual circumstances under which the wastes are produced.

31. A wide variety of technologies are used for recycling and conversion of waste. For any successful operation of waste recycling or conversion of waste, the importance of classification of waste at source should be emphasized taking into account both technical and legal criteria. Once classified into different categories, a number of methods are adopted depending on volume and availability of recovery/treatment facilities and the hazardous nature of the waste.

32. The various technologies for recycling and conversion of wastes may be broadly described for the following categories:

Recycling/Conversion Processes	Disposal Methods
Physical	Landfill
Chemical	Incineration
Thermal	Chemical/biological
Biological	Ocean dispersion
	injection
	Deep well injection
	Fixation/encapsulation

Obstacles to further progress

33. Following are some of the regulatory and institutional barriers to making further progress:

- Most laws are oriented towards "end of pipe" and sectoral approaches to environmental management. There is a need to give more stimulus to operational innovation;

- Waste minimization principles are not sufficiently integrated into other policy areas, for example industrial development programmes;

- Tax laws often discriminate against preventive action;

- The institutional and infrastructural framework for waste minimization may be inadequate;

- Government specifications for public purchases are often formulated in such a way that they do not encourage and promote the use of recycled materials.

34. Economic and financial barriers include:

- The full environmental costs ("externalities") are not generally integrated into the prices of products. As a result, market signals do not provide incentives to waste minimization;

- Developing country firms often lack access to credit facilities or the foreign exchange needed for investing in cleaner production technologies.

35. Barriers to innovation and diffusion include inter alia:

- Lack of appropriate clean technologies or techniques;
- Lack of investment in basic research on waste minimization;
- Lack of awareness of potential solutions, where they exist;
- Lack of international coordination on waste minimization successes;
- Poor dissemination of technical information;
- Lack of integral and standardized systems to measure environmental performance;
- Lack of employee training and sensitization to waste minimization issues.

36. Industrial and management obstacles include:

- Environmental factors are often not integrated into mainstream operating practices;
- Lack of awareness of the financial and other benefits of waste minimization;
- Difficulties for a company to introduce cleaner production practices due to factors relating to the overall economic conditions facing its sector;
- The adoption of cleaner production integrated strategies may involve a greater degree of risk for companies than end of pipe solutions;
- Reluctance among suppliers to change from end-of-pipe technologies to new customized clean technologies;
- Producers could have limited room for manoeuvre due to the influence of suppliers and/or customers over their processes;
- Small and medium sized enterprises face particular awareness and capability problems, linked to their scale.

II. ENVIRONMENTAL AND HEALTH IMPACTS ASSOCIATED WITH HAZARDOUS WASTES

37. A major objective for the sound management of wastes is to avoid harm to environment and human health due to improper treatment and disposal of such wastes.

Current status

38. Hazardous wastes, if not properly dealt with, soon find their way into the environment. Waste liquids have been pumped into unlined pits allowing them to percolate into the soil, contaminating groundwater reservoirs. Both solid and liquid wastes have been dumped on public grounds, discarded in derelict buildings, and abandoned in vacant city lots, in farmers' fields and on the roadside. Hazardous wastes have also been "land-filled" with municipal garbage or burned in incinerators not equipped with proper pollution control equipment. Because of such disposal methods, many harmful substances have entered the environment, endangering human health and threatening ecosystems.

39. The principal environment hazard of abusive waste disposal is the contamination of soil and groundwater. Cleaning-up operations in almost every hazardous waste site involve the treatment of contaminated groundwater. Groundwater contamination results largely from the disposal of hazardous wastes in unlined land-fills or dumps where it leaches into soils and surface waters, some of it eventually reaching the groundwater supplies. Because of the multiple effects and unstable nature of hazardous wastes the same chemical, for example, can foul soil, water and air. Other, more indirect routes pose equally serious health threats. Heavy metals, such as lead and cadmium, can be taken up by crops grown in contaminated soil. Trace chemicals, leached from dumps, can also find their way into the bottom sediments of rivers and lakes.

40. A common way of disposing of hazardous waste is by inappropriate incineration or open burning. Incinerators that are not designed for specific types of hazardous wastes will release toxic substances and particulate matter into the atmosphere. These often settle on the ground, slowly seeping into water-courses. Moreover, the combustion residue, itself a toxic waste, poses further disposal problems. The direct discharge of untreated or partially treated wastes into water-courses, which is often done, permits hazardous substances to be dispersed over wide areas, with the result that (1) water supplies become contaminated and irrigation water fouled; (2) some of the substances such as PCBs and DDT may be taken up by living organisms, passing through the food chain to human beings; and (3) some toxic substances may be deposited in the bottom sediment from where they will be released in small amounts over a period of years.

41. The different kinds of adverse health effects induced by hazardous waste include:

- Accidental injuries which result from improper handling of chemical waste. These range from the effects of explosions and fire to passive exposure of those handling the waste. Medical and hospital wastes often contain needles and broken glass, which can cause lacerations, punctures and, more seriously, infections;

- Acute poisoning caused by inhalation or ingestion of chemical waste products. The people who make their living from scavenging dumps and disposal sites are at particular risk, especially children who often help adults search for salvageable materials, or use dumps as play

sites. Past experience has shown that when containers for transporting toxic materials are discarded they are often picked up and used by the poor for storing water or food supplies;

- Chronic poisoning caused by long-term exposure to chemical products present in air, water and food. In many cases hazardous chemicals reach these media because of the lack of safe treatment and disposal techniques. Some such chemicals have been shown to be carcinogenic, neurotoxic, immunotoxic, mutagenic and teratogenic, affecting future generations;

- Spread of infectious and parasitic diseases from hospital wastes, sewage sludge and untreated human and other organic wastes.

42. A major health issue, particularly in those countries with scarce water reserves, is the potential that hazardous wastes have for poisoning groundwater supplies. Today, over one billion people rely directly on groundwater as their sole supply of potable water. Unfortunately, this type of pollution is difficult to detect; its adverse effects are often only revealed years after pollution.

43. Long-term exposure, especially of sensitive population groups such as newborn babies and children, pregnant women, the elderly, the malnourished, or the diseased may result in the development of chronic, sometimes irreversible ill- effects and the exacerbation of existing diseases. Concern has been increasing in recent years about the possible carcinogenic and mutagenic effects due to long-term exposure to some of the chemicals contained in wastes.

44. Aside from the potential adverse effects on health, there are also environmental effects. Leachates from landfills and runoff from land which has been spread with hazardous wastes, poisoned agricultural wastes and sewage sludges can cause serious water pollution resulting in changes in ecosystems, massive fish kills and other detrimental environmental effects. The disposal of wastes in coastal zones and the marine environment can have diverse and harmful effects such as the reduction or alteration of the fauna living on the sea bed and oxygen depletion. Careless hazardous waste disposal contributes to the continued global contamination with persistent chemicals which may move through the food web and affect sensitive species thereby upsetting subtle ecological balances and posing threats to human health.

45. Research on the health and environmental risks of hazardous wastes is still in its early stages

46. The actions most needed for health and environmental protection include:

- Identification of disposal sites and the hazardous wastes they contain;

- Surveillance and assessment of the exposures which could occur;

- Evaluation in environmental impact assessment (EIA) procedures of the potential adverse effects which could occur;

- The establishment of protective measures including health and environmentally based standards.

47. A collaborative effort of national and international programmes is needed to address these and related issues.

Work by international organizations

48. The major issues identified at the end of the last section are dealt with to varying degrees by the international organizations. While the work with risk evaluation of hazardous wastes per se is limited, the work of evaluating toxic chemicals in general is more advanced. Such evaluations are also applicable for hazardous wastes. Thus the work of the International Programme on Chemical Safety (IPCS: UNEP, ILO, WMO), is relevant to hazardous wastes. Coordinated by IPCS, the UN agencies have prepared Environmental Health Criteria, Health and Safety Guides and International Chemical Safety Cards. These cover important chemicals, many of which are constituents of hazardous wastes, and a practical set of guidelines on the methodology for the assessment of human health and environmental effects of hazardous wastes with particular emphasis on developing countries. The Scientific Group on Methodologies for the Safety Evaluation of Chemicals (SGOMSEC) is developing methods for the assessment and predictive evaluation of human health and environmental risks. WHO, through its Regional Office for Europe, is involved in a study on health risks associated with hazardous wastes, for both the occupationally exposed and the population at large.

49. UNEP's International Register of Potentially Toxic Chemicals (IRPTC); has compiled information on more than 800 hazardous chemical compounds and their known effects on health and the environment which is available to any Member Government on short notice through on-line computer connections.

50. Information on environmental contamination and the associated exposures due to hazardous waste is inadequate. Very little data are available on the actual exposures which occur. There is also lack of information on the transformation of chemicals as they move through different exposure pathways. While there is no major specific international effort under way to assess exposures of populations or ecosystems to hazardous wastes, there are activities which contribute in this area. These include the UNEP (GEMS)/WHO programmes on water quality monitoring and the human exposure assessment. WHO intends to carry out an assessment of groundwater contamination. WHO, through its Regional Office for Europe, is involved in a study to identify a list of priority chemicals in hazardous wastes which may be disposed of by land-filling in Europe.

51. The identification of potential hazardous wastes sites and the characterization of their chemical constituents is a major task ahead. In this connection UNEP is in the process of developing, as part of its training programme, a methodology for preparing hazardous waste inventories and analyses.

52. Management of hazardous wastes for health and environmental protection is the subject of a series of initiatives by a number of international organizations including WHO, UNEP and the World Bank. The World Bank published in 1989 a Technical Manual on the Safe Disposal of Hazardous Wastes with Special Emphasis on the Problems and Needs of the Developing Countries. WHO, UNEP and the World Bank prepared short practical guidelines dealing with

high priority wastes. WHO, through its Regional Office for Europe, has published jointly with UNEP a guide entitled "Management of Hazardous Wastes - Policy, Guidelines and Code of Practice". Guidelines on management of wastes from hospitals have been issued by WHO's Regional Office for Europe. Work is under way by WHO in the different regions and countries to strengthen national programmes through workshops, intercountry projects and training activities.

53. The UNEP Industry and Environment Office, in cooperation with other international organizations, is providing assistance to countries in the implementation of the Cairo Guidelines and the Basel Convention through seminars and training workshops, in particular for government experts from developing countries.

54. FAO has published guidelines on the disposal of bulk quantities of unwanted pesticides. UNIDO has held workshops on the subject of occupational health and safety and industrial hygiene and on environmental concerns in pesticide production plants.

55. There is a need to establish or strengthen programmes for environmentally sound management of hazardous wastes in accordance with health and environmental standards. Surveillance systems need to be extended and inventories of hazardous wastes and their treatment/disposal sites should be established and maintained. Dissemination of technical and scientific information on health aspects of hazardous wastes, and development and dissemination of educational materials concerning waste and their impact on the environment and health are other important requirements to promote environmentally sound management of hazardous waste.

III. ECONOMICS OF WASTE MANAGEMENT

56. The Basel Convention delineates a group of wastes which should be managed as hazardous wastes. This list consists of heavy metals and certain organic and inorganic compounds which inter alia are corrosive, flammable, and toxic, both to humans and ecologically. As countries develop and grow, the generation of such wastes are likely to increase.

57. Development activities vary by function and over time, with resulting distinctive types and quantities of hazardous wastes. Thus, planning should incorporate development approaches which ensure that capital investments will reduce and minimize wastes generation and maximize the efficiency of waste management.

Key issues

58. Waste minimization, recycling, and the use of cleaner production methods have important economic consequences, both in terms of costs and benefits. However, their costs are more easily quantifiable in monetary terms than the benefits. The various costs include, but are not limited to, the expenses of proper treatment, storage, disposal, and transportation of hazardous wastes, administrative, compliance, and enforcement costs, remedial costs of pollution, research and development costs of improved technologies and switch-over costs to improved technologies.

59. The economic benefits of environmentally sound management of hazardous wastes, however, exist primarily as they relate to the reduction of health hazards, both acute and chronic, and the reduction of adverse effects on natural resources such as arable land,), and wildlife. The benefits of waste minimization and cleaner production methods are therefore essentially the reduction of opportunity costs. Of consideration, consumers, particularly in the industrialized nations, are more willing to apply consumer pressure on those companies that represent significant risk to human health and the environment.

60. The costs of hazardous waste management (treatment, storage, and disposal) are high due to their intrinsic character. These costs are increasing as more and more amounts are produced, as well as with the generation of wastes increasingly more hazardous which require more complex (and therefore costlier) management.

61. The different methods for managing wastes in an environmentally sound manner, and their costs, vary from place to place and over time. Aggregate estimates indicate that OECD European Member countries spend between $US 2 and 3 billion annually to dispose of hazardous wastes, while estimates for the United States are $US 16 to 19 billion annually. The average price to legally dispose of one ton of hazardous waste in the OECD area is roughly $US 70, ranging from $US 20 to 3,000. In addition, costs to remedy problems and potential threats posed by improper disposal of hazardous wastes in the past are estimated to be about $US 3 billion annually in the OECD area. Highly hazardous wastes are likely to cost the most to dispose; obviously, these wastes also represent potentially large gains to those who can arrange lowest cost disposal.

62. Potential victim compensation costs in the US could add an additional $US 1.5 to $US 3 billion per year, given current proposals. Data on potential victim compensation costs for Europe have not been collected. Incremental control costs for hazardous waste are estimated as $US 740 to 890 billion annually in Europe and about $US 3 to 3.5 billion in the US. Hence, if controls avoid future problems (due to regulation compliance), then the benefit-to-cost ratio for control is likely to be unity or higher.

63. Legal costs in the United States for lawsuits associated with remedial actions at old hazardous waste sites have been estimated to range from $US 5 to 8 billion. Hazardous waste-related lawsuits are also occurring in the courts of many OECD countries. According to one authority, corporate managers cannot leave all litigation decisions to lawyers. Rather, they must plan aggressively to avoid or minimize involvement with the courts, because, win or lose, the costs of litigation are high.

64. As the costs of legal disposal go up it is becoming increasingly cost effective to minimize the quantity of waste generated. Yet legal disposal costs still vary widely, raising the question as to whether or not low cost disposal options adequately reflect longer term social costs.

Key Economic Instruments

65. In principle the full marginal cost of providing waste treatment should be internalized as much as possible, and incentives created for the minimization of wastes and the development of new technologies. The use of economic instruments can therefore improve approaches to waste management in a number of important ways.
Charges on the disposal and treatment of wastes play a useful role in helping to recover the costs associated with waste management and providing revenues needed to fund waste management programs. In practice however, charges are rarely set high enough to have much incentive impact in reducing wastes. On the other hand setting them too high can encourage illegal dumping.

66. To minimize the generation of hazardous wastes, governments can exact a tax on generation or disposal. This follows the "Polluter Pays Principle". Such taxes tend to increase the cost per unit of the product manufactured and can result in the product losing its competitive position. This concern leads some countries to keep the tax low.

67. In developing countries particularly, the tax is often set too low to affect management practices. At the same time enforcement is often weak, leading to problems of unlicensed disposal.
Government taxes are usually linked to regulations on generation, transportation, storage, and disposal of hazardous wastes. The revenues are often directed into funds designed to improve adequate treatment, transportation, storage, and disposal facilities.

68. In some cases government subsidies are provided to promote certain waste management practices. These have not always encouraged environmentally sound practices. In other cases such subsidies are used to help deal with already exsiting problems, an example being the Comprehensive Environmental Response, Compensation, and Liability Act of the United States, better known as the Superfund. Subsidies are an exception to the polluter pays principle.

69. The costs of pollution should be applied to all potentially responsible parties (waste operators, waste generators, and anyone involved in the transportation, treatment, or disposal of hazardous wastes). Liability is usually determined by court action or out-of-court settlements. The assignment of legal liability is designed to ensure that the damages are in fact paid. In the United States, even lending institutions that finance hazardous waste site operators or users may be held responsible for clean-up measures.

70. Legally establishing liability of polluters for environmental damage or clean-up costs associated with emissions, storage or transport of wastes may lead to the creation of a market in which risks of damage penalties are transferred to insurance companies, with premiums reflecting the probable damage or clean-up costs and the likehood that damage will occur. Some countries have already moved to make such insurance compulsory in the case of some kinds of hazardous wastes.

Major activities

71. The Urban Management and Environment component of the joint UNDP/IBRD/UNCHS Urban Management Programme represents a major coordinated approach by the United Nations. One activity is the development of strategic options for pollution control and waste management. With particular reference to hazardous waste management, regulatory and economic instruments are being elaborated, describing the framework for developing standards, permits and licenses, land-use controls, pollution charges, subsidies, and enforcement incentives.

72. The OECD has developed a set of general Principles which are meant to serve as the basis for a framework of international cooperation, to ensure adequate environmental protection and control at the lowest practicable cost. Implementation of such Principles will require international cooperation founded on strong and effective national laws and regulations meant to provide adequate control over hazardous wastes. UNEP has also put forward proposed guidelines for the environmentally sound management of hazardous wastes.

73. Several OECD member countries have chosen to define what may be termed the "best environmental option" for managing various classes and types of hazardous wastes. The "Technical Instructions - Wastes" of Germany, the myriad of US Federal Register notices concerning hazardous wastes, and Dutch restrictions concerning land disposal of certain types of waste are just a few examples. Such restrictions concerning legal disposal methods combined with ever-increasing public opposition to the creation and approval of facilities/sites for hazardous waste disposal have played a major role in causing the price of legal disposal to increase sharply in the past several years.

74. Cultural differences and experiences will cause variations in standards for hazardous waste management. The Royal Commission on Environmental Pollution (UK) recently defined a best practicable environmental option as being;

> "...the outcome of a systematic consultative and decision-making procedure which emphasizes the protection of the environment across land, air and water. The procedure establishes, for a given set of objectives, the option that provides the most benefit or least damage to the environment as a whole, at acceptable cost, in the long term as well as in the short term".

75. Very few empirical data exist concerning quantities of hazardous waste produced by type and industrial sector. Additionally, very little information is readily available concerning the fate of hazardous wastes outside of the OECD countries.

IV. EDUCATION, TRAINING, RESEARCH AND CAPACITY BUILDING

Introduction

76. The need for education and training covers a broad spectrum ranging from detailed technical training for engineers and scientists who deal with hazardous chemicals, to occupational training for workers who handle them, to public information on how to safely handle these chemicals in every day use.

77. There is a need for research to improve understanding of the nature of hazardous materials, to identify their potential environmental effects, and to develop technology to safely handle them. Research is also needed on broader systems studies, data base development, and environmental risk assessments used to cope with hazardous materials.

78. Capacity building is needed to strengthen institutions and organizations. These include government regulatory agencies that deal with hazardous materials, hazardous material control groups within industry, the hazardous waste service industry, and the hazardous material research community within university and industrial structures.

Current approaches and activities

79. The current approach to education and training, research, and capacity building varies widely among countries. In industrialized countries, there are usually well-established mechanisms for developing skilled technical personnel and for conducting research programs, and for informing the public. These range from university undergraduate and graduate programs in the science and engineering disciplines, to short courses of several days to several weeks on hazardous material handling and management, to widespread public information programs.

80. At the international level, the efforts to manage hazardous materials include inter alia the following:

- The UNEP Industry and Environment Office Cleaner Production Network (CPN) promotes low and non-waste technologies through information exchange and technology transfer. The International Cleaner Production Information Clearing-house (ICPC) is based on United States Environmental Protection Agency's Pollution Prevention Information Clearinghouse. So far, most of the CPN effort has been on the transfer of rather sophisticated technology from large to small industries in the industrialized countries or to installations in developing countries that are run by multinational corporations.

- The UNEP International Registry of Potentially Toxic Chemicals (IRPTC) compiles information about specific chemicals and their potential hazards and makes it available to all participating countries.

- The International Environment Bureau, supported by the International Chamber of Commerce, provides technical advice to industries in developing countries on solving environmental problems, including hazardous materials management. Short-term consultants are provided to resolve specific problems.

- The Pacific Basin Consortium for Hazardous Waste Research is a non-governmental organization bringing together researchers in the hazardous waste field to exchange information and research results. Special provisions are made for developing country professionals to receive training in connection with regular technical meetings and collaborative research efforts.

- The International Program on Chemical Safety (WHO, ILO, UNEP) attempts to harmonize chemical safety and hazardous waste management and provides training.

- Many bilateral assistance agencies and multilateral development banks provide support to developing countries for training and education. Some also have programs that are especially designed for strengthening local institutions. Issues related to hazardous wastes are renewed in environmental impacts analysis which often leads to training programmes for operating staff.

Key issue and future needs

Education, public awareness and training

81. There is a pressing need for more training of industrial and governmental workers who deal with hazardous materials, especially in developing countries. Likewise, there is a need to develop systems and institutions for providing objective information on hazardous wastes to the general public. Thus there is a need for each country to develop a strategy for providing the needed training and for the necessary strengthening of educational and training functions.

Research

82. In general, there has existed only very limited support for research activities on hazardous materials. In developing countries there is almost none. Most development assistance agencies do not finance research in this area. Without a strengthening of locally-based research, developing countries will not be able to generate the kind of hazardous materials control programs appropriate for local conditions. A local research program based on finding locally- appropriate solutions is a critical element of hazardous materials control.

83. Special efforts are needed to help small and medium scale industries in developing countries. These manufacturers, while individually discharging only small amounts of hazardous materials, collectively can be a major source of pollution. Operators of these industries generally have little or no background or skill in handling hazardous materials. Likewise, they have no funds for treatment of hazardous wastes. Appropriate solutions for these industries must be developed and implemented. Solutions that require minimal capital investment, that can be used by marginally skilled workers, that can be applied to "low- technology" industrial operations, and that will not interfere with production operations are needed. Promising approaches include inter alia simplified and down-sized end-of-pipe treatment technology, centralized collection and processing of wastes and expanded waste treatment

equipment, siting of waste generators to facilitate collection and treatment, development of less hazardous replacement chemicals for small scale processes and development of useable markings and warning labels in local languages and easily understandable symbols for application in developing country industries.

84. Most of the research on health effects currently available pertaining to hazardous wastes has been done under industrialized country conditions. The situation in developing countries is sufficiently different to warrant separate studies. Physical climate conditions in tropical regions may have a sizeable impact on the dispersion of hazardous materials in the food chain, into ground water, and in the atmosphere. The generally poorer health of residents of developing countries may increase the effect of toxic chemicals. Little is known about overlaying chemical exposure on top of traditional health risks. Research may indicate the need for different standards of protection under these conditions.

85. Existing research on the elimination or reduction of the use of hazardous materials and the generation of hazardous waste needs to be expanded. Incentives for conducting this type of work include regulatory pressure, economic benefits, and product enhancement possibilities. Special programmes are needed for disseminating the results. A research effort that can result in waste minimization techniques available without proprietary restrictions would be particularly valuable. This could be supported by government agencies, by foundations, or by inter-industry trade associations. Not only must innovative technical research be carried out, but innovative dissemination of results should be implemented.

86. With many new chemicals being introduced annually, more emphasis needs to be placed on identifying problems before they become serious and developing proper handling procedures for hazardous materials before they are widely distributed. This type of anticipatory research can avoid costly clean up activities at a later date.

87. Apart from the hardware-type research, there is need for research on the assessment and management activities involved in hazardous material control. Examples of needed research include:

- Use of systematic techniques, such as decision analysis, to prioritize hazardous material control efforts and allocate scare financial and skilled personnel to the most pressing problems;

- Techniques such as risk assessment. These are just beginning to be used in industrialized countries to establish efficient control programs. They need to be extended to developing countries;

- Determination of hazardous materials movement in the physical environment and through the food chain;

- Development of data bases on hazardous materials effects, generation, movement, and ultimate disposition.

Capacity Building

88. There is a need for government agencies to deal with hazardous materials from the regulatory perspective. Those at greatest risk from hazardous chemicals and derivative wastes are the industrial workforce. Occupational health and safety agencies must be alert to new hazards. Workplace exposures provide invaluable information on human responses that can be used to augment laboratory animal test data. Monitoring of exposure to potentially toxic materials is essential. Most countries have authorities responsible for environmental public health protection. These agencies should have the responsibility for establishing appropriate hazardous material regulations, for monitoring hazardous materials movement through the economy, for enforcement of the regulations, and for identifying research needed to deal with toxic materials.

89. Industrial organizations need to have their own institutions to provide support to the special needs of each industry in handling toxic materials. These institutions include in-company divisions that have the responsibility for addressing an individual company's hazardous materials and multi-company trade associations that can be an effective network among the companies to share hazardous material control information and techniques. An environmentally conscious, industry-based organization frequently will have more success in getting new environmentally sound technologies adopted.

90. A critical element of a country's hazardous materials control program is a hazardous waste service sector. In industrialized countries, this business has expanded rapidly to cover all aspects of hazardous waste management: survey and inventory, transport, storage, treatment, disposal, site selection, and risk assessment. Without such an industry, each waste generator must acquire the skills and equipment to deal with its own hazardous material. Not only is this inefficient, but it is unlikely that all generators will gain the necessary competence. Governments can foster the growth of a local service industry by providing contracts for handling hazardous materials. Local engineering firms can also form joint ventures with foreign firms until they develop the proper level of expertise. Regulations can be written to encourage the collection and centralized treatment of hazardous materials, the construction of centralized incinerators, and the siting of secure landfills. Private sector companies can implement these facilities and save the government capital investment. Another advantage of a local hazardous waste service industry is that it will speed up the transfer of technology and its adaptation to local situations. International programs should encourage the formation of these service industries by working with trade associations, chambers of commerce, productivity councils, and industrial firms.

91. The existing international networks that connect professionals in the hazardous materials area need to be expanded. These networks serve to maintain an information flow among countries. Most importantly, the application of research results to reducing risks can be speeded up through these contacts. Both the government-to-government networks and the non-government networks need to be maintained and expanded.

V. INFRASTRUCTURE OF HAZARDOUS WASTE MANAGEMENT SYSTEMS: WASTE TREATMENT CENTRES

92. The proper handling of special waste depends on high technical competence and proper management. Both issues are costly to develop and maintain and consequently, cost-efficient management of waste is essential.

93. On the other side, the policies for reducing the hazards of waste have been focused on reducing the movement of such waste.

94. In developing countries, where hazardous waste is usually produced in smaller quantities, there is a policy dilemma between the option of utilizing local or national treatment centres to reduce the transport and transboundary movement of waste, and the need to be cost-effective by concentrating investment in management and equipment in a few sub-regional or regional centres.

95. Three factors must be considered in determining the right balance between economies of scale and geographical distribution:

- Costs of transportation;
- Distribution of collection centres;
- Types of wastes.

96. The task is to find out the optimum distance from a treatment centre at the "hub of the wheel" to the various bulking or concentration centres. This may differ from product to product.

97. Some of the benefits of regional or sub-regional centres may be as follows:

Allow waste handling competence to be accumulated in a scientifically responsible way

Establishing pilot waste centres would help to develop a research and development network which concentrates region-specific competence in dealing with specific waste problems, including assessment of minimization technologies, recovery and recycling of residues.

Permit small-and-medium-sized companies to access waste competence

Regional centres will allow smaller, marginal producers to build on the expertise developed in larger producing units.

Developing training and waste-reduction competence

The objective of sustainable development is not primarily waste treatment, but waste reduction at source. Regional centres therefore would need to become centres for disseminating scientific and managerial information on the "non-waste", total lifecycle approach to hazardous waste management.

98. These regional approaches would require a strong emphasis on the safe movement of waste. i.e. transportation and handling. Surveillance and control mechanisms can reduce transportation and handling dangers substantially. Emergency preparedness to cope with accidents should also be emphasized as part of an international effort to reduce the risk of hazardous waste movement.

VI. HARMONIZATION OF CRITERIA FOR THE STRENGHTENING OF INTERNATIONAL COOPERATION IN MONITORING TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES

Current international activities

99. As already elaborated upon in the Progress Report on "Environmentally Sound Management of Wastes, particularly Hazardous Wastes" prepared for the Second Session of the UNCED Preparatory Committee (A/CONF.151/PC/34), several international organizations are in the process of developing or have developed international regulations, control systems and instruments applying specifically to hazardous wastes. There is the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal and the recently adopted Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement of Hazardous Wastes within Africa. In addition to what was mentioned in that report, activities undertaken by other organizations are, principally:

- The European Community focuses especially on the development and implementation of rules to monitor and control waste exports from the Community and waste management inside the Community. The Community is currently discussing a proposed Council Regulation on the supervision and control of shipments of waste within, into and out of the European Community which is required for the Community to ratify the Basel Convention.

- The International Maritime Organization Assembly adopted a resolution on the "Transboundary movement of hazardous wastes", requesting its Committees to review jointly the relevant rules, regulations and practices with respect to the marine transport of hazardous wastes in the light of the Basel Convention with a view to recommending any additional measures needed, in order to assist coastal States, flag States and port States in fulfilling their responsibilities with respect to the protection and preservation of the marine environment. IMO Committees on Marine Safety and Marine Environment Protection concurred that the sub-committees on Bulk Chemicals, on Containers and Cargoes and on the Carriage of Dangerous Goods should review their respective Codes regulating the transport of wastes by sea vis-a-vis the obligations under the Basel Convention. This review should be completed soon. A review of the provisions of the London Dumping Convention (LDC)(1972), has been undertaken in light of the requirements of the Basel Convention. The LDC Secretariat in co-operation with the Interim Secretariat for the Basel convention (ISBC) is compiling a table comparing the provisions of the LDC with those of the Basel Convention with a view to the elaboration, if necessary, of standards which are compatible to those established by the Basel Convention.

- A UN-ECOSOC Committee of Experts on the Transport of Dangerous Goods is working on proposed amendments to the UN Recommendations for transport of dangerous goods to ensure alignment with the Basel Convention classification of hazardous wastes.

- The Organization of African Unity has approved the Bamako Convention on the Ban on the Import of All Forms of Hazardous Wastes into Africa and the Control of Transboundary Movements of such Wastes Generated in Africa which was adopted at the Pan-African Conference on Environment and Sustainable Development in Bamako, Mali, in January 1991.

- The International Labour Organization General Conference adopted a Convention concerning safety in the use of chemicals at work during its 32nd sitting on 25 June 1990.

- The General Agreement on Tariffs and Trade Working Group on Domestically Prohibited Goods and Other Hazardous Substances has prepared a draft text of a Decision on Products Banned or Severely Restricted (including hazardous wastes) in the Domestic Market.

Main issues and constrains and possible approaches

100. In relation to the need for harmonization of criteria and procedures being used in various international conventions and legal instruments, one has to consider whether it is possible to promote full harmonization among the many diverse international classification systems, standards, criteria for classification and regulations while, at the same time, ensuring adequate coverage of each particular case dealing with transport, handling, storage, disposal or recovery of hazardous wastes.

101. Secondly, criteria for classification will take into account specific concepts, ie: wastes, transport, safety of workers, international trade, environmental and health protection, etc.. As such, criteria would differ depending on the "target group". Different criteria should be used to address different purposes (ie: criteria for safety regulations on transport of dangerous goods compared to criteria for the environmentally sound disposal of hazardous wastes).

Identification and classification of hazardous wastes

102. International agreements concerned with disposal of wastes into marine bodies contain lists of potentially hazardous wastes and agreements governing transport of dangerous goods include waste as well. Furthermore, many other international instruments being reviewed or adopted seek to classify wastes. Finally, lists of potentially hazardous wastes have been issued or are being developed by many individual countries and the Basel Convention has developed a core list of hazardous wastes to be controlled. Fortunately, there is considerable similarity among the lists. This will facilitate the harmonization process.

Harmonization process

103. The main objective is to ensure that the "hazardous waste" concept is incorporated into existing and future international instruments which cover one or several aspects of waste management (ie: transport, disposal at sea, handling, etc).

104. This implies that the prior informed consent principle adopted in the Basel Convention should be reflected in transport agreements. The notification to be submitted in advance of any intended movement to the State of import and to any Transit State concerned, must contain information on the designation and physical description of the waste including its composition.

Harmonization of regulations

105. It is a complex, time-consuming and evolving process to achieve simultaneous and harmonious application of international regulations. National legislation with regard to liability for damage caused by waste needs to be compatible with that of other countries. Reliable data for comparing types and quantities of hazardous wastes generated, imported, exported or disposed of should be obtained.

106. Harmonization of national legislation and regulations with the provisions of the Basel Convention for countries that are not Party to the Basel Convention could be achieved through the formulation of regional approaches or regional agreements regulating transboundary movements of hazardous wastes, such as the recently adopted Bamako Convention referred to in the previous section. The development of technical guidelines for the environmentally sound management of the wastes covered by the Basel Convention could provide a framework for reaching common norms. In addition, the transfer of information as required by the Convention will facilitate the harmonization process.

Harmonization of criteria

107. Guidelines for the identification of hazardous wastes could be developed at the national level taking into account internationally agreed criteria. A list of hazard profiles could be prepared based on existing work done by the United Nations. An indication of the testing method used to identify harmful waste would be useful. In addition, countries could adopt safety standards based on international consensus or agreed standards for managing hazardous wastes in an environmental sound way. Basic safety principles could be derived from the various internationally recognized frames of reference.

108. In order to aim at harmonization between the existing international conventions, codes or regulations including the Basel Convention and the Bamako Convention, there is a need to reconcile waste nomenclatures.

109. Any attempt towards harmonization of criteria and regulations can be seen as a highly complex process requiring time and regular dialogue between the concerned actors. sting the hazardousness of wastes.

VII. RESPONSIBILITIES OF EXPORTING COUNTRIES

110. In accordance with the provisions of the Basel Convention, the exporting countries have several obligations to fulfill. These obligations could be devided into the following categories:

1. Obligations towards parties to the convention who banned the importation of hazardous wastes (article 4, para. 1(b).

2. Obligations towards the non-contracting parties (article 4, para.5).

3. Obligations towards parties to the Convention in case of a transboundary movement of hazardous wastes (article 6 and article 8).

4. Obligation in case if illegal traffic due to the state of experts (article 9, para.2).

5. Obligation to present an annual report to the Conference of the parties on the amount of hazardous wastes and other wastes exported, their categories, characteristics, destination and disposal method (para 3(i) of article 13).

VIII ADOPTION OF NORMATIVE MEASURES

111. Parties to the Basel Convention have or will develop policies for the environmentally sound management of hazardous wastes. Such policies should be prepared on the basis of common elements and principles derived from relevant existing international public laws, guidelines or principles.

112. Progress in the establishment of normative measures will depend, in part, on the development of internationally agreed criteria for both the classification of wastes and for the environmentally sound management of the wastes.

113. The harmonization of standards for testing and assessment of hazards would facilitate the international application of regulatory measures and ensure the safe management of hazardous wastes. The Basel Convention and the Bamako Convention are, for instance, addressing these points by providing an international framework for the establishment of internationally acceptable norms and regulatory measures aimed at the environmentally sound management of hazardous wastes.

IX. PROBLEMS ENCOUNTERED IN THE RATIFICATION OF THE BASEL CONVENTION

114. Four issues remain unresolved with regard to the Basel Convention. Some delegations have suggested that three out of these four issues could not be solved by incorporating them in the form of articles in the Convention. They contended that these are complex issues which need to be elaborated in annexes or protocols as they constitute by themselves detailed systems related to the movement or disposal of hazardous wastes.

115. These three issues are:

(a) Mechanisms for the implementation of the Basel Convention;

(b) Liability;

(c) Technical guidelines for the environmentally sound management of wastes.

116. The fourth unresolved issue is related to radioactive wastes which were excluded from the scope of the Convention in accordance with Article 1. In order to cover the concerns expressed by some countries in relation to the importance of dealing with such matter in a parallel way to Basel, the Plenipotentiary Conference adopted Resolution 5 recognizing the need to harmonize procedures of this Convention and the IAEA Code of Practice on the International Transboundary Movement of Radioactive Wastes.

117. The ad hoc Working Group of Legal and Technical Experts held two sessions: the first session in Geneva from 2-6 July 1990 and the second in Nairobi from 6-9 March 1991. During these two sessions, the Working Group was able to complete its work by agreeing on the elements which might be included in a protocol on liability and compensation for damage resulting from the transboundary movement and disposal of hazardous waste and other wastes.

118. With regard to Resolution 5 this has been implemented by the adoption at its thirty fourth regular session of the IAEA Code of Practice which reaffirms the general principles and objectives of the Basel Convention.

119. The Basel and Bamako Conventions address the question of adopting normative measures by requesting all Parties to take appropriate legal, administrative and other measures within the area under their jurisdiction to prohibit the import of hazardous wastes from non-contracting Parties. Furthermore, both Conventions refer to the need to prepare protocols setting out appropriate rules and procedures in the field of liabilities and compensation for damage resulting from the transboundary movement of hazardous wastes. At the end of April 1991 the Basel Convention had been ratified by ten countries.
